

disturbance prevailed off the coast of northern California.—*A. G. McAdie, Professor.*

### PORTLAND, OREG., FORECAST DISTRICT.

During the first decade of the month two severe storms passed over the district, for which timely warnings were issued. The unusually high wind velocities of 72 miles southwest at Tatoosh Island, and 80 miles south at North Head occurred during the night of the 8th. Just at the close of this stormy period the German bark *Alsternirie* stranded at the mouth of the Columbia River while attempting to sail across the bar without a pilot. No lives were lost and the ship was afterwards floated and safely dry docked. From the 11th until the close of the month fair weather generally prevailed in consequence of disturbances appearing too far south to cause rain in the North Pacific States. Incoming vessels reported few storms east of the one hundred and eightieth meridian along the northern track of steamers plying between Asiatic and north Pacific ports.—*E. A. Beals, Forecast Official.*

### AREAS OF HIGH AND LOW PRESSURE.

*Movements of centers of areas of high and low pressure.*

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>										
I.....	1, a. m.	53	108	7, a. m.	32	65	Miles. 3,175	Days. 6.0	Miles. 529	Miles. 22.0
II.....	4, a. m.	45	123	8, a. m.	47	65	2,825	4.0	706	29.4
III.....	6, p. m.	39	120	10, a. m.	37	76	2,950	3.5	843	35.1
IV.....	12, p. m.	54	114	16, p. m.	47	101	725	4.0	181	7.5
V.....	14, a. m.	47	123	18, a. m.	30	82	2,900	4.0	725	30.2
VI.....	17, a. m.	53	105	20, a. m.	32	65	2,800	3.0	933	38.9
VII.....	19, p. m.	44	116	23, p. m.	32	65	3,100	4.0	775	32.3
VIII.....	22, a. m.	54	114	25, p. m.	40	75	2,250	3.5	643	26.8
Sums.....							20,725	32.0	5,335	222.2
Mean of 8 paths.....							2,591		667	27.8
Mean of 32.0 days.....									648	27.0
<b>Low areas.</b>										
I.....	1 a. m.	39	120	5, p. m.	46	60	3,600	4.5	800	33.3
II.....	4, a. m.	34	118	9, p. m.	46	60	3,925	5.5	714	29.8
III.....	7, a. m.	48	123	12, p. m.	46	60	3,300	5.5	600	25.0
	8, p. m.	35	112				3,450	4.0	862	35.9
IV.....	14, p. m.	35	112	17, p. m.	46	60	2,350	3.0	793	32.6
V.....	19, a. m.	54	114	22, p. m.	46	60	2,625	3.5	750	31.2
VI.....	25, a. m.	32	106	28, p. m.	48	68	2,925	3.5	836	34.8
Sums.....							22,175	29.5	5,345	222.6
Mean of 7 paths.....							3,168		764	31.8
Mean of 29.5 days.....									752	31.3

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

### RIVERS AND FLOODS.

At the end of February there was considerably more ice in the rivers of the northern districts than at the corresponding date of 1902, although the upper Mississippi was not frozen so far to the southward. The increase varied from 1 to 7 inches in the upper Mississippi and from 4 to 10 inches in the Missouri. The actual thickness in inches at a few selected stations was as follows: Moorhead, Minn., 38; Bismarck, N. Dak., 33; Sioux City, Iowa, 24.5; Omaha, Nebr., 14.5; St. Paul, Minn., 24, and Davenport, Iowa, 14.5.

The river stages of the lower Missouri and upper Mississippi did not differ materially from those of the preceding month.

Over the Ohio Valley, the Gulf and Atlantic States, however, the precipitation was frequent and heavy, ranging from 2 to 10

inches above the normal amount without any unusually low temperatures. As a consequence, all the rivers of those districts rose to flood stages. The Mississippi below the mouth of the Ohio had passed the danger line at all points and was still rising steadily at the end of the month. Reports of these floods are given below, except those of the lower Ohio, lower Mississippi, and the Tennessee, which will be published later.

### PITTSBURG DISTRICT.

By Mr. Frank Ridgway, Official in Charge of the United States Weather Bureau office, Pittsburg, Pa.

The conditions prevailing on the morning of the 3d throughout all sections southwest of Pittsburg indicated rising temperatures, heavy rains accompanied by thawing, and general thawing conditions over the Allegheny and Monongahela valleys, and, as a consequence, high water. As all of the ice had passed out of the Allegheny and Monongahela rivers and their tributaries during the last week of January, a rise at this time could be caused only by the melting of what snow remained in the mountains and by heavy rains. On the 3d the rivers had begun to show the effect of the melting and during that night they were steadily rising. In addition to this, heavy rains were falling, due to the storm development in the southwest. At 8 a. m. of the 4th the rivers showed a rise at Pittsburg of about 4 feet, and reports indicated that all of the tributaries were rising steadily and that heavy rains were falling as anticipated. The upper river stations were immediately called upon for special hourly observations, and these showed an average rise of 0.2 to 0.5 foot an hour in all of the streams. At noon preliminary advices were sent out in all directions through special editions of the newspapers and by means of the telephone that all interests affected by high water should keep in touch with the Weather Bureau office night and day.

At 4 p. m. I informed the police departments of Pittsburg and Allegheny that all interests in the lower districts of their respective cities should be notified to make preparations for a stage of 23 feet by Thursday morning, February 5, and that all property affected by a stage of 25 feet should be moved at once. This information was also given to the press, which promptly published the same. The rivers rose slowly and steadily all that day and throughout the night. The danger line of 22 feet was passed at 3 a. m. of the 5th, and the maximum stage of 24 feet was attained at 9 a. m. of that day, making a total rise of about 7 feet in eighteen hours.

Mr. Ridgway also made the following report on the moderate flood of the 16th, when a 22-foot stage was reached at Pittsburg:

On the morning of the 16th the reports from the Monongahela and Kiskiminitas rivers and tributaries showed that heavy rains had fallen and that the rivers were rising rapidly. The stage at Pittsburg was then 12.9 feet, a rise of nearly 3.0 feet during the previous twelve hours. Special hourly reports were at once called for, but before they were received warnings were issued through the departments of police of Pittsburg and Allegheny, through the noon special editions of the press, by telephone, and by telegraph, notifying all concerned to make preparations for a stage of 22.0 feet, or over, at Pittsburg by midnight. Inspection of the special reports from the upper river stations soon disclosed the fact that the maximum would not be over 22.0 feet, as the Kiskiminitas, Monongahela, and tributaries were contributing all the water, the Allegheny River above Freeport doing practically nothing, as the heavy rains had not reached the upper Allegheny and tributaries, and what did fall there was controlled by low temperature. At midnight the stage at Pittsburg was 21.5 feet, a rise of 8.6 feet since 8 a. m., or a total rise of 11.7 feet. The river was then rising about two-tenths of a foot an hour, with all the upper streams about stationary. The maximum stage reached was 21.9 feet at 2 a. m. of the 17th, at which height it remained stationary until 4 a. m., when the water commenced to fall. At 8 a. m. of the 17th it showed a stage of 21.3 feet and was falling at the rate of 0.2 of a foot an hour. No warnings were necessary for points below Pittsburg.

### CINCINNATI DISTRICT.

By Mr. S. S. Bassler, Official in Charge of the United States Weather Bureau office, Cincinnati, Ohio.

During the month of February, 1903, there were two overflows of the Ohio River, neither of which, however, quite reached the danger line in the Cincinnati district, except at Point Pleasant, W. Va.

On February 2 there was a decided local rise of 11.3 feet during the twenty-four hours ending at 8 a. m. Heavy rainfall in the immediate region caused a rapid rise in the neighboring streams emptying into the Ohio near this point. Truck gardens were overflowed and much early vegetable stuff destroyed. Traction lines suffered considerably and traffic was delayed. Merchants in the "Bottoms" became anxious about the rising water, and kept in touch with the Weather Bureau office. They

were individually informed through the telephone of approaching stages, rendering removal of goods from cellars necessary.

A local warning was issued that the river would reach the danger line, 50 feet, but all business interests that could stand 51 feet were advised that under present conditions they would not be disturbed.

High winds and a cold wave following the rains undoubtedly checked the rise of the river, which kept coming up slowly until a stage of 49.4 feet was reached at 7 p. m. of the 8th, 0.6 of a foot below the official danger line.

No damage was done in the city and there was no suffering due to high water, but there was much loss to garden truck in the rich bottoms in the vicinity, and much valuable timber, among other drift, floated by the city.

On the 5th a warning was telegraphed to Point Pleasant, W. Va., that the river there would exceed the danger line, 39 feet, by several feet, and on the 6th, a danger-line warning, 50 feet, was sent to Portsmouth, Ohio, mainly because of the behavior of the Scioto emptying into the Ohio at that point. The warning to Point Pleasant was verified, the river there reaching about 41 feet on the morning of the 7th. The warning to Portsmouth fell short about two feet. By the morning of the 8th the entire river above Cincinnati was again falling.

Heavy rains on Sunday, the 15th, resulted in another rapidly rising river from Pittsburg down. At Cincinnati the stage had receded to 30.3 feet. A sharp rise was forecast, the local stage to exceed 45 feet by the evening of the 17th, which it did at 10 p. m. Merchants in the "Bot-toms," though but recently recovered from a flood scare, renewed preparations for high water. All affected by less than 50 feet were advised to immediately clear out their cellars. On the morning of the 17th warning was telegraphed to Point Pleasant that the river would pass the danger line that night. The situation was believed to be sufficiently serious to warrant a general warning, that the river would exceed the danger line throughout the Cincinnati district, and warning was sent on the 17th to the observers at Huntington, W. Va., Catlettsburg, Ky., and Portsmouth, Ohio, to this effect. But high winds and cold weather again prevented the water from coming to as high a stage as it undoubtedly would have reached under other circumstances. At Point Pleasant it reached a crest stage of 40.8 feet at 9 p. m. of the 17th; at Huntington, W. Va., it stopped at 47 feet during the night of 17-18th; and at Catlettsburg it stopped at 47.1 at about 7 p. m. of the 18th; at Portsmouth the crest stage was 47.7 at 3 a. m. of the 19th, and at Cincinnati, after several periods of inactivity it reached the maximum stage of 49.4 at 9 p. m. of the 19th, where it remained stationary until 11 a. m. of the 20th when it began to fall.

#### CHATTANOOGA DISTRICT.

By Mr. L. M. Pindell, Official in Charge of the United States Weather Bureau office, Chattanooga, Tenn.

The lowest water stage during the month was 4.8 feet on the 1st. The river rose slowly until 6 a. m. of the 3d when the rate of rise increased, becoming rapid after 1:30 a. m. of the 4th, owing to the heavy rainfall over the river system. The river became stationary at 6:40 a. m. of the 6th, with 19.6 feet on the gage; it began to fall after 1 p. m. on the 6th and continued to fall slowly until the 11th, when heavy rains again occurred causing nearly a 2-foot rise by 6 p. m. of the 11th; it fell steadily from 9 a. m. of the 13th to 7 a. m. of the 16th. Rain set in over the system on the 15th and continued until the 17th. The river began to rise rapidly after 1:30 p. m. on the 16th and reached a crest of 29.5 feet at 4:15 p. m. on the 19th. On the 17th, a stage was forecast of about 30 feet by Wednesday night, the 18th, with the crest below the danger line. The lower river at Riverton, Ala., passed the danger line and reached a crest of 28.7 feet on the 20th and 23d, or 3.7 feet above the danger line, and at Florence, Ala., it reached 17.7 feet on the 22d, or 1.7 feet above the danger line. The river at Chattanooga began to fall after 6 a. m. of the 20th; the rate of fall was rapid from 10 p. m. of the 20th to noon of the 23d, then slower to noon of the 27th when another rainstorm passed over the system, producing copious rains over the central portion, from Bridgeport, Ala., to Clinton and Knoxville, Tenn. The river began to rise at 7 p. m. on the 27th and rose very rapidly during the 28th, reaching 23.5 feet at 11:59 p. m. The river forecast issued Saturday morning, February 28 was as follows: "The river will rise very rapidly to night and slower Sunday (March 1). A stage of 27 feet is expected by 8 a. m. Sunday. The crest will occur between Sunday night and Monday morning, and will be about 31 feet." The river reached 31.1 feet at 11:40 a. m., Monday, March 2. The rapid rise in the river at Chattanooga and over the headwaters had reached Bridgeport, Ala., when the month closed, and the conditions were favorable for the rise near Florence and Riverton to continue for the next seven or eight days and for the river to near the 20-foot mark at Florence and the 30-foot mark at Riverton. The month closed with the river rising rapidly. The copious rainfall of the 27-28th, caused washouts and landslides on the various railroads, delaying traffic and causing a heavy loss to the various companies. The most serious accident was the wreck of passenger train, No. 30, on the main line of the Southern Railway near Lenoir, Tenn.; 3 persons were killed and 22 injured; all mail was destroyed. No losses occurred above Bridgeport, Ala.

#### RICHMOND DISTRICT.

By Mr. E. A. Evans, Official in Charge of the United States Weather Bureau office, Richmond, Va.

Precipitation rather general, though light in character, prevailed over the State during the 14th and 15th, wetting the ground thoroughly and raising the volume of water carried by the James River somewhat above the normal for the time of year. This period of precipitation was closed by the severe storm of the 16th, when high winds with rain, sleet, and moist snow occurred, the total amounts deposited ranging from 1.00 inch to about 2.50 inches. Owing to the saturated soil and the decreased evaporation incident to the season a rather high percentage of run-off occurred and though the resulting flood heights were within quite moderate limits, the proportion of rise to precipitation was greater than usual.

On the early morning of the 17th telegrams from several of the special river and rainfall stations showed rising water in the James River and tributaries, and at 9 a. m. an advisory warning of a 12-foot stage at Richmond was issued, the rise to occur by the morning of the 18th. During the day there was a slow but steady rise and toward midnight the water began to approach the dock level at the wharves of the various navigation companies. By the morning of the 18th the river had covered the docks of the Virginia Navigation Company, the Clyde and Old Dominion Steamship Lines, and had encroached upon the street car tracks of the Virginia Passenger and Power Company at the depressed portion of Lester street, near the river, interrupting traffic and making transfer of passengers by row boat necessary. The water remained high during the day covering the steamboat wharves to a depth of 2 to 5 feet, but at night began to recede slowly and by the afternoon of the 19th was almost within the banks of the river.

The usual means were taken to distribute the warnings and they were effective, no damage occurring as far as could be ascertained.

The cold weather following immediately on the heels of the storm causing the flood was of great assistance in checking the run off and undoubtedly prevented a higher stage of water.

The forecast called for a 12-foot stage by the morning of the 18th and the maximum stage reached was 11.9 feet at 8 a. m. on that day.

#### CHARLESTON DISTRICT.

By Mr. L. N. Jesunofsky, Official in Charge of the United States Weather Bureau office, Charleston, S. C.

The streams of South Carolina were at high stages throughout the entire month of February, and there were four distinct flood periods, viz., 5-6th, 8-9th, 12-13th, and 17-19th, corresponding closely with the heavy rainfalls over the upper drainage areas of the 3d-4th, 7-8th, 10-11th, and 15-16th.

The Wateree River at Camden, S. C., rose 15.6 feet during the 5th and 6th; 11.7 feet on the 8th and 9th; 7.0 feet on the 12th, and 13.7 feet on the 17th and 18th. The river was above the danger line during the 8th, 9th, 10th, 12th, 13th, 18th and 19th.

At Cheraw, S. C., on the Pedee River, there was a rapid rise of 20 feet on the 5th and 6th. An additional rise of 11.3 feet on the 8th and 9th forced the water up to the 31.3-foot mark, or 4.3 feet above the danger line. There was a slow rise from 8 a. m. of the 9th to 4 p. m. of the 10th, at which time the maximum gage reading of 31.6 feet was recorded. On the morning of the 11th, although the river was falling rapidly, the gage reading 23.8 feet, the decline was suddenly checked by another rise which forced the water up to a gage height of 26.6 feet on the 12th, and 28 feet at the 8 a. m. observation of the 13th. The river remained above the point of danger for thirty-two hours, after which it receded rapidly for three days. On the 17th, with a stage of 15 feet at 8 a. m., it commenced to rise slowly, and by the 8 a. m. observation of the 18th, had risen to a height of 28.8 feet, or 1.8 feet above the point of danger. At 4 p. m. of the 18th the gage showed a reading of 29.9 feet, and at 7 a. m. of the 19th a stage of 30.4 feet was recorded. On the morning of the 20th a rapid fall was again in progress.

The Congaree River at Columbia, S. C., was 4 to 5 feet above the danger line on the 8th and 9th, when there was a rise of 16.7 feet. At 8 a. m. of the 8th the gage read 19.3 feet, and at 12 noon, 20.5 feet. The water remained stationary from this time until 9 a. m. of the 9th, when it began to recede slowly.

Heavy rainfall on the upper Broad River during the 15th and 16th brought the Congaree River to a stage of 16.7 feet on the morning of the 18th, a rise of 12.9 feet since the previous morning. There was a decline of 13.7 feet from the 19th to the 22d, inclusive.

The lower Pedee at Smiths Mills, S. C., began to rise rapidly on the 12th, and reached the danger line on the 16th. From the 17th to the 19th, inclusive, it remained stationary at a stage of 17.4 feet, 1.4 feet above the danger line, and began to recede slowly during the morning of the 20th, falling below the danger line on the morning of the 28th.

The flood waters in the Wateree and Congaree rivers produced very high stages in the Santee River at St. Stephens, S. C., from the 15th to the 26th, during which period the stream was above the danger line.

Warnings were, as a rule, well distributed previous to the approach of

the flood waters, and but little damage was reported, except at Camden, S. C., on the 8th and 9th, where the rising waters tore away a portion of a dam entailing considerable loss. The flood of the last two days of the month continued during the early days of March and will be mentioned in the WEATHER REVIEW for that month.

#### MACON DISTRICT.

By Mr. J. R. Weeks, Official in Charge, of the United States Weather Bureau office, Macon, Ga.

The weather chart on the morning of the 7th did not afford sufficient indications of heavy rains to justify cautionary river warnings, but by that evening it was seen that there would probably be a brisk rise in both the Ocmulgee and Oconee rivers, and the local press were so informed, the public being advised that a brisk rise might be expected and that stockmen and others should be on the lookout. At 8 a. m. of the 8th the river at Macon having risen 11.3 feet during the past twenty-four hours, the fact was communicated in a special bulletin to river addresses below Macon as far as Hawkinsville, Ga. At 10 a. m. a second bulletin was issued to all river addresses and the local press, containing the following forecast: "A brisk rise may be expected in the Oconee and Ocmulgee rivers, covering lowlands and passing Hawkinsville, Ga., Monday night, Abbeville, Ga., Thursday or Friday, and Evergreen, Ga., Sunday or Monday of next week. In the Oconee River the crest will reach Beech Hill and Oconee, Ga., Monday or Tuesday, and Dublin, Ga., about the middle of the week (this week)." The rainfall in the river district for the twenty-four hours ending at 8 a. m. was as follows: Covington, 2.20 inches; Macon, 1.52 inches, and Milledgeville, 2.52 inches. The river at Macon continued to rise during the day, covering the lowlands and surrounding the houses in the bottoms, until at 4 p. m. it was 21.0 feet, or 3 feet above the danger line, and about on a stand. A bulletin was then issued to all river addresses containing this information and the following forecast: "Be prepared for a freshet not quite equal to that of March, 1902." The river rose very slightly during the night and at 8 a. m. of the 9th was 21.2 feet, or 2 feet below the freshet of March, 1902. It began to fall during the day and by the morning of the 10th was 18.4 feet. The morning chart on that day, however, showed that rain would fall that night and the next day, and might be heavy; a special edition of the weather map was, therefore, issued to all river addresses and contained the following caution: "Important. All river interests should watch conditions carefully in regard to freshets in Oconee, Ocmulgee, and Altamaha rivers. Should heavy rains occur to-night or Wednesday in upper districts communication by mail will undoubtedly be interrupted from Macon to most points below. Stock should be removed from lowlands and preparations made to care for movable property if necessary. The freshet passed Macon Monday morning with a stage of 21.2 feet, but might be increased and hastened should heavy rains fall in next twenty-four hours."

By the next morning (February 11th) the freshet in the Oconee reached Dublin, the gage at that place showing a rise of 10.0 feet, and a stage of 21.0 feet. A special edition of the morning weather map issued to river addresses contained the following information: "The river at Dublin rose 10 feet in the past twenty-four hours; it will continue to rise more slowly to-day and probably Thursday, about equaling the freshet of 1902. Heavy rains occurred last night as follows: Atlanta, 1.48 inches; Covington, 1.70 inches; Milledgeville, 1.08 inches; Dublin, 0.52 inch; Macon, 1.14 inches. This will cause a second rise in the Ocmulgee, the crest passing Macon to-morrow, which will equal and may exceed the freshet of 1902. Rain continued at Atlanta this morning."

The forecasts for the Oconee and previous forecasts for the Ocmulgee were fully verified, but the rapid fall in the Ocmulgee before the second rain and the fact that the larger amounts were in the extreme upper portion of the district made the river fail, fortunately, to reach as high stages as were expected for the second rise. It rose, however, to danger line and continued high during the day and night. The rise in the Oconee passed Dublin February 13 with a stage of about 25 feet, almost equal to the freshet of March, 1902.

As far as possible the public was kept fully advised of river conditions during this period, and the office was kept very busy preparing the bulletins and answering inquiries. Active steps were taken by all river interests to care for property, and, because of this, the damage caused by the freshet is believed to have been comparatively slight. The railroads between Atlanta and Macon and to the southeast were inconvenienced because of high water and a few families living in the bottoms were compelled to move from their homes. The Macon Telegraph on the 9th spoke as follows: "These warnings, together with the caution published in the Telegraph yesterday, will give all parties—rice planters, rivermen, stockmen, and others ample time to prepare, in fact from a day at Hawkinsville to nearly three weeks at Darien. An idea of the river interests in southeast Georgia can be gained from the fact that \$140,000 worth of property was reported saved in March of last year because of warnings issued from the Macon office of the Weather Bureau and published in the Telegraph."

The bulletins and warnings are greatly appreciated by the many recipients and are at once distributed by them to their neighbors. The Erie Lumber Company, Lumber City, Ga., through its secretary and

treasurer, says: "These reports are almost a godsend to rivermen, boatmen, and officers having roads and bridges to protect." Numerous similar commendations from others have been received. Mr. N. L. Grayson, United States Overseer, Hollingsworth Ferry, Ga., states that he received the warning one hundred and sixty-eight hours before the crest of the rise reached him. Owners of property valued at between \$25,000 and \$75,000 from Jacksonville to Hawkinsville, Ga., were at once notified by steamboat, and about 90 per cent of it was saved, together with timber and Government property in his charge, because of the warnings. The total value of the property saved by the warnings was about \$150,000.

#### MONTGOMERY DISTRICT.

By Mr. F. P. Chaffee, Official in Charge of the United States Weather Bureau office, Montgomery, Ala.

Moderately heavy rains occurring over the watershed of the upper Coosa River during the early morning of the 7th instant, and the weather conditions being such as to portend still heavier rains over this region, special 3 p. m. reports were called for from all substations, and advisory warnings issued for those interested in the rivers to keep in close touch with this office. The 3 p. m. reports showing continued heavy rains over middle Alabama, warnings were issued at 5 p. m. that the heavy rains would continue through the following night, and that river stages of 25 feet, or more, would be reached at Wetumpka, Montgomery, and Selma, Ala., during the next day, with continued rise during the two or three days following.

Morning reports of the 8th showing the 24-hour rainfall as ranging from about an inch over the upper portions of the State to 4 inches at Selma and Milledgeville, Ala., with the Coosa, Alabama, and Tallapoosa rivers rising very rapidly, flood warnings were issued for all points from Gadsden to below Selma, Ala., the following stages to be reached, if not exceeded:

Gadsden 19, and Wetumpka 45 feet during following night; Montgomery 42 feet during following morning, and Selma 46 feet within next two days; advice was also given that live stock and other perishable property from above Wetumpka to 100 miles below Selma should be moved to high ground.

During the 9th the river went to one foot above the danger line at Gadsden, and attained 45 feet at Wetumpka and 41.2 feet at Montgomery. By the morning of the 10th it had reached 45.9 feet at Wetumpka, beginning to fall slowly after that time; at Montgomery it reached 45.6 feet the evening of the 10th, and was stationary for about two hours; at Selma it continued to rise slowly, reaching 41 feet at 3 p. m.

Additional heavy rains over the drainage area of these rivers during the night of the 10-11th started secondary rises, and supplementary warnings were issued on the morning of the 11th for slightly higher flood stages in the upper Coosa, and for stages of about 50 feet at Wetumpka and Montgomery, and 52 feet at Selma; advice was also given that residents in low grounds of north Montgomery, which is flooded at about 48 feet, should move their household effects to higher ground. On the morning of the 12th the estimated maximum stages for Wetumpka and Montgomery were lowered to about 49 or 49.5 feet and for Selma to about 51 feet.

The flood crest (47.2 feet) passed Wetumpka about 5 p. m. of the 11th, Montgomery (48.6 feet), about 1 p. m. of the 13th, and Selma (50.6 feet), at 8 a. m. of the 15th.

The distribution of the warnings of these floods gave the first thorough trial of the scheme perfected last summer, by which each substation repeats the warnings to all points within a certain district. The plan worked most satisfactorily and gave the widest possible dissemination of the information. The warnings were so far in advance of the high waters as to receive the hearty commendation of the press.

The value and appreciation of the warnings is best shown by the following extract from the Montgomery Journal of February 14, 1903:

"Now that the flood danger is about over, it seems proper to note the great value the freshet and flood warnings of the Weather Bureau have been to the various interests of this section. Had the high water come unheralded, the loss of life in the low grounds might have been considerable, and the property loss certainly would have been great. As it is, not a single loss of life has been reported from the freshet, and the property loss was comparatively slight."

"It certainly shows the inestimable value of the river and flood service of the Weather Bureau."

Flood stages were also experienced in the Susquehanna, lower Roanoke, Cape Fear, Savannah, Chattahoochee, Tombigbee, and Black Warrior rivers. The usual warnings were issued at the proper time, and no reports of serious damage have been received.

The floods in the White, Black, Ouachita, Red, and Atchafalaya rivers continued at the close of the month, and the descriptions thereof will be included in the report of the lower Mississippi flood, which will be issued at a later date.

The heavy rains of the 25th and 26th over the Texas watershed caused rapid, dangerous, and destructive rises in the rivers of that State a few days later. General warnings were widely disseminated on the 26th. The report of this flood will appear in the WEATHER REVIEW for March, 1903.

During the month the River and Flood Service was extended to the Passaic River of New Jersey, with headquarters at Philadelphia, Pa., and the Hudson River service, Albany, N. Y., district, was greatly enlarged and improved.

Stations were established on the Passaic River and tributaries as follows: On the Passaic River at Chatham, N. J.; on the Rockaway River at Old Boonton, N. J.; on the Ramapo River at Mahwah, N. J., and on the Pompton River at Pompton Plains, N. J.

This service will be maintained with the cooperation of The Society for Establishing Useful Manufactures, Paterson, N. J., through its Chief Engineer, Mr. John H. Cooke. While the Passaic River is a comparatively small stream, its total drainage area being but 949 square miles, it is nevertheless an extremely important one on account of the great commercial interests located along its lower portion and dependent upon it for

power. The Passaic floods are sudden and at times dangerous and destructive to both commercial and agricultural interests, and it is hoped that the new service will be able to give timely and effective warnings of approaching flood waters.

For the benefit of the Hudson River service new stations were established as follows, all within the State of New York: On the Hudson River at Corinth, Glens Falls, Mechanicsville, Cohoes, Troy, Castleton, and Stuyvesant; on the Mohawk River at Utica, Little Falls, Fort Hunter, and Schenectady; on Schroon River at Warrensburg; on the Sacondaga River at Northville; on the Hoosick River at Hoosick Falls and Schaghticoke; on Schoharie Creek at Schoharie Junction and Millpoint, and on West Canada Creek at Trenton Falls.

The highest and lowest water, mean stage, and monthly range at 167 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

## CLIMATE AND CROP SERVICE.

By MR. JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions during February are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

**Alabama.**—Excessively wet and unfavorable; very little farm work was done, though some corn and cotton land was prepared in southeast counties, where rainfall was least; floods in all large streams and much lowland inundated. Severe cold wave of 17–18th killed young oats, very early fruit, and nearly all early trucking crops; wheat and fall sown oats were slightly damaged. Fruit prospect doubtful, as recent damage by freeze can not be determined until later in the season.—*F. P. Chaffee.*

**Arkansas.**—Farming operations were delayed by continued unfavorable weather; the ground was too wet to plow and very little of this work was accomplished; some cotton remains unpicked and can not now be gathered. Early sown wheat and oats were in good condition generally, but it is believed that the late sown were injured by too much rain. Indications are that the entire peach crop was apparently destroyed by the cold snap; the buds were frozen and killed in almost every section, though reports were more favorable in some localities. Apples, pears, and small fruits were not injured.—*Edward B. Richards.*

**Arizona.**—The weather during the greater part of February was abnormally cold; the precipitation was generally in excess of the normal, but in some localities there was a deficiency; the greater part of the precipitation fell during the first decade. The supply of irrigation water was adequate and will be ample the rest of the season. Grain and alfalfa and the ranges generally were in good condition. Frozen ground has delayed seeding in some localities, and many peach and almond blossoms were killed by frost. Stock has suffered somewhat by severe weather in the colder portions of the Territory.—*M. E. Blystone.*

**California.**—Abnormally low temperatures prevailed throughout the State until near the close of the month. Severe frosts caused some damage to citrus fruits, and the continued cold and cloudy weather retarded the growth of grain and grass. Deciduous fruit trees were benefited by the cold, which checked premature budding. Early wheat was in good condition and early fruits were in blossom at the close of the month.—*Alexander G. McAide.*

**Colorado.**—Over a comparatively small area in the center of the State, in Lake, Summit, Eagle, and the northern part of Gunnison counties the total snowfall was considerably less than normal, but in general other parts of the mountain region appear to have had the normal amount or an excess. The bulk of the current fall has been swept into huge drifts in the timber, gulches, etc., where it is likely to remain hard packed and practically solid ice until after later snowfalls have melted.—*F. H. Brandenburg.*

**Florida.**—The month was warmer than the average, with an abnormal amount of precipitation, the latter having a very unfavorable bearing on the vegetable crop. Over portions of Dade County the losses were quite heavy, prospects being reduced one-half. The warm, cloudy weather was very favorable to citrus trees, which made a splendid growth. Early corn was pushing forward, and land is largely prepared for cotton. A small

acreage was planted to melons. The month was unfavorable to strawberries.—*A. J. Mitchell.*

**Georgia.**—The chief meteorological features of the month were the high mean temperature, the heavy rainfall in the northern and western sections, and the severe cold wave of the 16th to 18th. The temperature was characterized by three periods of unseasonably warm weather. From the afternoon of the 16th to the morning of the 17th the temperature fell 40° to 60°. The rainfall was the heaviest on record for February since 1892. The total monthly amounts exceeded 13 inches at several stations. Little or no farm work was accomplished. The cold wave of the 16th to 18th was especially injurious to peaches in the northern section, but in the middle and southern fruit belts the effects of the cold weather were less marked. Winter wheat and oats were in good condition.—*J. B. Marbury.*

**Idaho.**—The records for the month showed unusual deficiency in both temperature and precipitation; no greater extremes of cold were experienced than in previous years, but the cold was continuous throughout the month, the mean at many places being the lowest ever known; precipitation was mostly in the form of snow, slightly increasing the depth of snow at very high elevations, but not adding materially to the supply throughout the State; at the close of the month the snow was drifted considerably and well packed.—*E. L. Wells.*

**Illinois.**—The temperature was above the seasonal average the first half of the month; a period of cold weather of unusual severity prevailed from the 16th to the 20th; the precipitation was very unevenly distributed; a general and opportune snowstorm began on the night of the 14th, and it afforded ample protection to wheat during the ensuing cold wave. Wheat was in a promising condition at the end of the month. Fruit sustained injury from cold in the southern district.—*William G. Burns.*

**Indiana.**—Snow covered the ground in the north section throughout most of the winter and in the central and southern sections during the severe cold weather, affording good protection to wheat, and the crop at the end of February was unusually promising; rye, clover, and other grasses were also in fine condition; on account of the snow in the north section and rough or muddy fields in the central and southern sections considerable corn remained in the fields at the close of the month. Many correspondents in the southern section reported on the last of February that most if not all peach buds were dead.—*W. T. Blythe.*

**Iowa.**—Month generally favorable for stock and for farm operations usual in winter; fall wheat, rye, and grass were not materially affected by low temperature; at the close of the month snow had disappeared and the weather was spring like.—*John R. Sage.*

**Kansas.**—A cold month; the first and last days were warm and the middle portion cold. Wheat was well covered with snow during the cold part and was further benefited by the wet snow of the 24–27th, and was in good condition. Ground too wet for plowing or oat sowing in south. Some corn in field damaged by wet snow. Peach buds reported killed in central counties.—*T. B. Jennings.*

**Kentucky.**—Crops were fairly well protected by snow during the severe weather. In the western counties some damage was caused by floods. Early sown wheat was in excellent condition and the outlook for the crop as a whole was encouraging. Rye and oats were in good condition. Farm work was badly delayed; very little was done toward burning to-